Remarks

The Office Action mailed 31 January 2003 has been received and reviewed. Claims 26 and 31-32 having been amended, the pending claims are claims 1-11, 13-15, and 17-32.

The Examiner has withdrawn claims 26 and 31-32 from consideration as being drawn to a non-elected invention. Claims 26 and 31-32 have been amended to recite methods of manufacturing fluid handling devices. The amendments are supported, for example, by claims 18, 28, and 30, respectively. In view of the amendments to claims 26 and 31-32, Applicants respectfully request that the Examiner reconsider and withdraw the restriction requirement.

Reconsideration and withdrawal of the rejections are respectfully requested.

Applicants' Invention

In one aspect, the present invention provides a fluid handling device that includes *diamond-like glass* (e.g., independent claims 1, 18-19, 24-25, and 27-30). In another aspect, the present invention provides a fluid handling device that includes a *diamond-like glass (DLG) film* (e.g., independent claim 20). The *diamond-like glass* includes a dense random covalent system including on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen (e.g., independent claims 1, 18-19, 24-25, and 27-30). The *diamond-like glass film* includes a dense random covalent system including at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than about 45 atomic percent oxygen, on a hydrogen-free basis (e.g., independent claim 20).

Applicants have specifically selected *diamond-like glass* for use in the methods and fluid handling devices of the present invention. *Diamond-like glass* includes "a substantial quantity of silicon and oxygen, as in glass" yet retains diamond-like properties and is "highly transparent and flexible (unlike glass)" (specification, page 13, lines 27-30 and 32-34). Certain preferred embodiments of the invention may include optically transmissive films including

diamond-like glass (e.g., independent claims 1, 19, 25, 27, and 29). Certain preferred embodiments of the invention may include hydrophilic films including *diamond-like glass* (e.g., independent claims 18, 19, 25, 28, and 30). Furthermore, in certain preferred embodiments, *diamond-like glass films* of the present invention are at least 50 percent transmissive to radiation at one or more wavelengths from about 180 nm to about 800 nm (e.g., independent claims 29 and 30).

Additionally, in certain preferred embodiments, the diamond-like films of the present invention have substantially no fluorescence (e.g., specification at page 9, lines 7-8, and independent claims 27 and 28). *Diamond-like glass* is a preferred diamond-like film as it displays little if any fluorescence when imaged in a fluorescence microscope (e.g., specification at page 25, lines 9-15). It is particularly advantageous, for example, to provide a capillary that exhibits substantially no fluorescence when exposed to the light used to irradiate a target species in the instance where excitation is effected through the capillary wall. Such a capillary, for instance, does not require the film to be removed for optical detection of the samples (e.g., specification at page 9, lines 8-9).

Rejection under 35 U.S.C. §102

The Examiner rejected claims 1-11, 13-15, 17-25 and 27-30 under 35 U.S.C. §102(b, b, e, e,) as allegedly being anticipated by WO 98/33948, WO 98/59089, EP 0963455, or U.S. Pat. No. 6,228,471 (Neerinck et al.).

With respect to the rejections based on WO 98/33948, WO 98/59089, or U.S. Pat. No. 6,228,471 (Neerinck et al.), Applicants respectfully traverse the rejection. None of the documents disclose or suggest a fluid handling device that includes a *diamond-like glass* (e.g., independent claims 1, 18-19, 24-25, and 27-30) or a *diamond-like glass (DLG) film* (e.g., independent claim 20), wherein the *diamond-like glass* includes a dense random covalent system.

Specifically, WO 98/33948 and U.S. Pat. No. 6,228,471 (Neerinck et al.) disclose "layered structures . . . comprising a first diamond like nanocomposite composition layer . . .

which . . . comprises *interpenetrating networks* of a.C:H and a.Si:O, a second diamond like carbon composition layer . . . , a transition layer . . . comprising a mixture of said diamond like nanocomposite and said diamond like carbon composition." (Abstract; emphasis added). The "diamond like nanocomposite composition" is not the *diamond-like glass* including a dense random covalent system as recited in Applicants' claims. Interpenetrating diamond-like films, referred to as DYLYN in the present specification, may have significantly different properties from the diamond-like glass films of the present invention due to the arrangement and intermolecular bonds of carbon atoms (e.g., specification at page 14, lines 12-18). Thus, WO 98/33948 and U.S. Pat. No. 6,228,471 (Neerinck et al.) fail to disclose or suggest a fluid handling device that includes *diamond-like glass* (e.g., independent claims 1, 18-19, 24-25, and 27-30) or a *diamond-like glass (DLG) film* (e.g., independent claim 20), wherein the *diamond-like glass* includes a dense random covalent system.

Similarly, WO 98/59089 discloses a "non-sticking diamond-like nanocomposite composition comprising networks of a-C:H and a-Si:O" (Abstract). "Diamond Like Nanocomposite (DLN) compositions consist of an amorphous random carbon network which is chemically stabilized by hydrogen atoms. The carbon *network is interpenetrated* with an amorphous glass-like *silicon network* which is chemically stabilized by oxygen atoms (a-C:H/a-Si:O)" (page 1, lines 14-18; emphasis added). Again, the "Diamond Like Nanocomposite (DLN) compositions" are not the *diamond-like glass* including a dense random covalent system as recited in Applicants' claims. Interpenetrating diamond-like films, referred to as DYLYN in the present specification, may have significantly different properties from the diamond-like glass films of the present invention due to the arrangement and intermolecular bonds of carbon atoms (e.g., specification at page 14, lines 12-18). Thus, WO 98/59089 fails to disclose or suggest a fluid handling device that includes *diamond-like glass* (e.g., independent claims 1, 18-19, 24-25, and 27-30) or a *diamond-like glass (DLG) film* (e.g., independent claim 20), wherein the *diamond-like glass* includes a dense random covalent system.

With respect to the rejection based on EP 0963455, the granted European Patent EP 0963455B1 was published on January 2, 2002, which is subsequent to the March 5, 2000 filing date of the present application. As such, the publication of the granted European Patent EP 0963455B1 is not prior art to the present application. Applicants wish to clarify that a 1449 form submitted by Applicants' Representatives listed a December 15, 1999 date for EP 0963455B1. However, this date is the publication date in Bulletin 1999/50 for the European Patent Application upon which the granted European Patent is based. Notably, the European Patent Office did not separately publish the European Patent Application, instead relying on International Publication No. WO 98/33948, which is discussed herein above.

Applicants respectfully request that the rejections under 35 U.S.C. §102 be reconsidered and withdrawn.

Restriction Requirement and Request for Rejoinder

Claims 26, 31, and 32 have been amended to recite methods of manufacturing fluid handling devices as recited, for example, in claims 18, 28, and 30, respectively. The amended claims (e.g., claims 26, 31, and 32) include all the claim language of claims 18, 28, and 30, respectively. Applicants respectfully request that the Restriction Requirement be reconsidered and withdrawn.

In the event that the Examiner maintains the Restriction Requirement and pursuant to M.P.E.P. §821.04, rejoinder of the non-elected method claims is respectfully requested upon notice of allowance of any of the elected product claims. *See, also, In re Ochiai*, 37 USPQ2d 1127 (Fed. Cir. 1995) and *In re Brouwer*, 37 USPQ2d 1663 (Fed. Cir. 1996).

Summary

It is respectfully submitted that all the pending claims are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

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CERTIFICATE UNDER 37 CFR §1.8:
The undersigned hereby certifies that this paper is being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Assistant Commissioner for Patents, Washington, D.C. 20231, on this 30 day of April, 2003, at 1:19 p.m. (Central Time).

By: _____
Name: Rachel Gylander-Graham

APPENDIX A - SPECIFICATION/CLAIM AMENDMENTS
INCLUDING NOTATIONS TO INDICATE CHANGES MADE
Serial No.: 09/519,448
Docket No.: 55436US002 (formerly 55436USA6A)

Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted. Additionally, all amendments have been marked in bold typeface.

In the Claims

For convenience, all pending claims are shown below.

1. A fluid handling device comprising a substrate and an optically transmissive diamond-like film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

2. The fluid handling device of claim 1 comprising a capillary having an internal surface and an external surface, wherein at least a portion of at least one of the internal or external surfaces includes an optically transmissive diamond-like film disposed thereon.

3. The fluid handling device of claim 2 wherein the external surface of the capillary includes an optically transmissive diamond-like film disposed on at least a portion thereof.

4. The fluid handling device of claim 1 comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface, wherein at least a portion of the fluid handling surface includes an optically transmissive diamond-like film disposed thereon.

5. The fluid handling device of claim 4 wherein the optically transmissive diamond-like film

is also hydrophilic.

6. The fluid handling device of claim 4 comprising:

a first non-elastic, polymeric substrate comprising a first major surface that includes the microfluidic handling architecture and a second major surface; and

a second polymeric substrate that is integrally bonded to said second major surface of said first substrate, wherein the second substrate is capable of forming a free-standing substrate in the absence of said first substrate.

7. The fluid handling device of claim 4 comprising a cover layer on the microfluidic handling architecture.

8. The fluid handling device of claim 7 wherein the cover layer is bonded to the first major surface of the first substrate.

9. The fluid handling device of claim 4 wherein the microfluidic handling architecture comprises structures selected from the group consisting of microchannels, fluid reservoirs, sample handling regions, and combinations thereof.

10. The fluid handling device of claim 9 wherein at least one of the structures comprises a fluid handling surface, at least a portion of which has the optically transmissive diamond-like film disposed thereon.

11. The fluid handling device of claim 4 comprising a first polymeric substrate comprising a first major surface that includes a plurality of microfluidic handling architectures and a second major surface, wherein the article is in the form of a roll.

13. The fluid handling device of claim 1 wherein the optically transmissive diamond-like film has disposed thereon linking agents and a reactant affixed to the linking agents to form a binding site.

14. The fluid handling device of claim 13 wherein the linking agents are covalently attached to the diamond-like film.

15. The fluid handling device of claim 13 wherein the reactant is selected from the group consisting of nucleic acids, proteins, and carbohydrates.

17. The fluid handling device of claim 1 wherein the diamond-like film is also hydrophilic.

18. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes a hydrophilic diamond-like film disposed thereon, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

19. A fluid handling device comprising a substrate and an optically transmissive and hydrophilic film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film has an extinction coefficient of no greater than 0.010 at 250 nm.

20. A fluid handling device comprising a substrate and a diamond-like glass film comprising a dense random covalent system comprising at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than about 45 atomic percent oxygen, on a hydrogen-free basis, disposed on at least a portion of the substrate.

21. The fluid handling device of claim 20 comprising a capillary having an internal surface and an external surface, wherein at least a portion of at least one of the internal or external surfaces has the film disposed thereon.

22. The fluid handling device of claim 21 wherein at least a portion of the external surface of the capillary has the film disposed thereon.

23. The fluid handling device of claim 20 comprising a microfluidic article comprising a microfluidic handling architecture including a fluid handling surface wherein at least a portion of the fluid handling surface has the film disposed thereon.

24. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture including a fluid handling surface wherein at least a portion thereof has disposed thereon a film comprising diamond-like glass which comprises a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

25. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture including a non-fluid handling surface wherein at least a portion thereof has disposed thereon a diamond-like film that is optically transmissive, hydrophilic, or both, wherein the film comprises diamond-like glass comprising a dense

random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

26. **(Amended)** A method of manufacturing **a fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes** a hydrophilic diamond-like film **disposed thereon**, the method comprising **manufacturing a hydrophilic diamond-like film by a method comprising** treating a diamond-like film in an oxygen-containing plasma, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

27. A fluid handling device comprising a substrate and an optically transmissive diamond-like film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film exhibits substantially no fluorescence.

28. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes a hydrophilic diamond-like film disposed thereon, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent

oxygen, and further wherein the film exhibits substantially no fluorescence.

29. A fluid handling device comprising a substrate and an optically transmissive diamond-like film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers.

30. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes a hydrophilic diamond-like film disposed thereon, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers.

31 **(Amended)** A method of manufacturing **a fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes** a hydrophilic diamond-like film **disposed thereon**, the method comprising **manufacturing a hydrophilic diamond-like film by a method comprising** treating a diamond-like film in an oxygen-containing plasma, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and

less than or equal to about 45 atomic percent oxygen, and further wherein the film exhibits substantially no fluorescence.

32. **(Amended)** A method of manufacturing **a fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes** a hydrophilic diamond-like film **disposed thereon**, the method comprising **manufacturing a hydrophilic diamond-like film by a method comprising** treating a diamond-like film in an oxygen-containing plasma, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers.